

## DIRECT SIMULATION OF THERMAL NEUTRON TRANSPORT PROCESSES USING EVALUATED NUCLEAR DATA FILES

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The most advanced information related to the accuracy of calculations is available in files of evaluated nuclear data libraries. The usual practice so far applied is that data processing is followed by the Monte Carlo method application. The main idea of the method proposed by us to directly extract the values required from data files. The method being developed allows to directly utilize the data obtained from libraries and seems to be the most accurate technique. Moreover, the method proposed doesn't introduce additional inaccuracy into the final results.

### INCOHERENT INELASTIC SCATTERING

Incoherent inelastic scattering is defined for a moderating molecule or crystal by

$$\frac{d^2\sigma}{d\Omega dE'}(E \rightarrow E', \mu, T) = \sum_{n=0}^{NS} \frac{M_n \sigma_{bn}}{4\pi kT} \sqrt{\frac{E'}{E}} e^{-\beta/2} S_n(\alpha, \beta, T),$$

where  $E$  is the incident neutron energy,  $E'$  is the secondary neutron energy,  $\beta$  is the energy transfer,  $\beta = (E' - E)/(kT)$ ,  $\alpha$  is the momentum transfer,  $\alpha = (E + E' - 2\mu\sqrt{EE'})/(A_0 kT)$ . The rest of the terms used here are commonly used terms. That is why they aren't given a detailed description. The function  $S(\alpha, \beta, T)$  may be presented in File 7 as a table with various interpolation laws or by analytical function using free gas scattering law or short collision time approximation.

### SIMULATING ALGORITHMS OF INCOHERENT INELASTIC SCATTERING

The simulated algorithms for case when  $S(\alpha, \beta, T)$  is given as a table of values are presented in [1]. New modifications of these algorithms will be presented in this paper. For the case when  $S(\alpha, \beta, T)$  is presented as analytical function using free gas scattering law or short collision time approximation we use the change of variables proposed by J.R. Eriksson for free gas model with variables  $p = \sqrt{\frac{\alpha A_0 kT}{E}}$  and  $q = \frac{\alpha + \beta}{2\sqrt{\alpha}}$ . For simulation of scattering we use Eriksson's algorithm with some modifications. For the short collision time approximation we use the same change of variables and obtain the next results:

$$f(p, q) = p e^{-(Ap^2 + Bpq + cq^2)},$$

where  $A = (\frac{T}{T_{eff}(T)} - I) \frac{E}{A_0 kT}$ ,  $B = 2(I - \frac{T}{T_{eff}(T)}) \sqrt{\frac{E}{A_0 kT}}$ ,  $C = \frac{T}{T_{eff}(T)}$ . In these formulas  $I=0$  if  $p < 2$ ,  $q < \frac{p}{2} \sqrt{\frac{E}{A_0 kT}}$  and  $I=1$  if it is not true. Both algorithms allows to directly simulate the incoherent inelastic scattering.

The comparisons of our results with MCNP and MCU results are presented in paper.

### REFERENCES

1. Androsenko P.A., Malkov M.R. Simulation of thermal neutron transport processes directly from the Evaluated Nuclear Data Files // Advanced Monte Carlo for Radiation Physics, Particle Transport Simulation and Applications, Proceedings of Monte Carlo 2000 Conference, Springer-Verlag, Berlin Heidelberg, 2001, p. 67.

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